OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Mirror Lake, Tuftonboro,** the program coordinators have made the following observations and recommendations.

Welcome to the New Hampshire Volunteer Lake Assessment Program! As your group continues to participate in VLAP each summer, the database created for your lake will help your monitoring group track water quality trends and will ultimately enable your group and DES to identify potential pollutant sources from the watershed that may affect lake quality.

As a rule of thumb, please try to sample at least once per month. In addition, it may be necessary to conduct rain event sampling at multiple locations along a stream using the bracketing technique to identify sources of pollution. Furthermore, baseline studies could involve bi-weekly or monthly sampling for an extended period of time. DES will let you know if this type of sampling is appropriate.

We understand that future sampling will depend upon volunteer availability, and your group's goals and funding availability. We would like to point out that water quality trend analysis is not feasible with only a few data points. It will take many years to develop a statistically sound set of water quality baseline data. Specifically, after 10 consecutive years of participation in the program, we will be able to analyze the in-lake data with a simple statistical test to determine if there has been a significant change in the annual mean chlorophyll-a concentration, Secchi disk transparency reading, and phosphorus concentration. Therefore, frequent and consistent sampling will ensure useful data for future analyses.

Please contact the VLAP Coordinator early this spring to schedule the annual DES lake visit. **It would be best to schedule the DES visit for early May to refresh your sampling skills!**

Finally, please remember that one of your most important responsibilities as a volunteer monitor is to educate your association, community, and town officials about the quality of your lake and what can be done to protect it! DES biologists may be able to assist you in educating your association members by attending your annual lake association meeting.

Thank you for your hard work sampling the tributary system to Mirror Lake this year! Five sample stations were established to bracket the tributary, starting at Abenaki Lagoon and ending at three stations along Lang Pond Road that discharge to Mirror Lake. Bracketing involves establishing sample stations above and below potential pollution sources to identify how potential sources are affecting water quality along the tributary.

As part of the Environmental Protection Agency's (EPA) National Lake Assessment (NLA) initiative, DES biologists performed a comprehensive lake survey on Mirror Lake in July during 2007. The NLA serves to survey the Nation's lake and determine the percentage of lakes that are in good, fair or poor condition. Lakes were randomly selected based on a statistical survey representing the population of lakes in their ecological region, but had to be at least one meter deep and over ten acres in size. Lakes were assessed using standard protocols, and the following parameters were measured: temperature, dissolved oxygen, nutrients, chlorophyll-a, cyanotoxins, water clarity, turbidity, color, zooplankton and phytoplankton, bacteria, macroinvertebrates, habitat condition, and sediment cores. Some data from this assessment has been included in this report and has been added to the historical database for your lake. Your lake's data will help to determine the regional and national condition of lakes. Also, those volunteer monitoring groups with historical data can compare the condition of their lakes on a statewide, regional or national level. Data from the National Lake Assessment will be compiled, entered into a national database, analyzed, and a draft report will be made available for public review. For more information about EPA's NLA please visit www.epa.gov/owow/lakes/lakessurvey.

We encourage your monitoring group to formally participate in the DES Weed Watchers program, a volunteer program dedicated to monitoring lakes and ponds for the presence of exotic aquatic plants. This program only involves a small amount of time during the summer months. Volunteers survey their waterbody once a month from June through September. To survey, volunteers slowly boat, or even snorkel, around the perimeter of the waterbody and any islands it may contain. Using the materials provided in the Weed Watchers kit, volunteers look for any species that are of suspicion. After a trip or two around the waterbody, volunteers will have a good knowledge of its plant community and will immediately notice even the most subtle changes. If a suspicious plant is found, the volunteers will send a specimen to DES for identification. If the plant specimen is an exotic species, a biologist will visit the site to determine the extent of the problem and to formulate a management plan to control the nuisance infestation. Remember that early detection is the key to controlling the spread of exotic plants.

If you would like to help protect your lake or pond from exotic plant infestations, contact Amy Smagula, Exotic Species Program Coordinator, at 271-2248 or visit the Weed Watchers website at www.des.state.nh.us/wmb/exoticspecies/survey.htm.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the lake has been monitored through VLAP.

  Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.55 mg/m^3.**

  The historical data (the bottom graph) show that the **2007** chlorophyll-a concentration, as measured for the NLA, was **1.60 mg/m^3** in **July**.

  The historical data (the bottom graph) show that the **2007** chlorophyll-a concentration is ***much less than*** the state median and is ***slightly less than*** the similar lake median. For more information on the similar lake median, refer to Appendix F.

  Please keep in mind that this trend is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

  After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

  While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency without the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope for each year the lake has been monitored through VLAP.

  Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can decrease due to the amount of algae and sediment in the water, as well as the natural color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

  The current year NLA data (the top graph) show that the non-viewscope in-lake transparency was **5.75 meters** in **July**.

  The historical data (the bottom graph) show that the **2007** non-viewscope transparency is ***much greater than*** the state median and is ***approximately equal to*** the similar lake median. Please refer to Appendix F for more information about the similar lake median.

  Please keep in mind that this observation is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

  Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, lake shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake has been sampled through VLAP.

Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake/pond can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year NLA data for the epilimnion (the top inset graph) show that the phosphorus concentration was **7.7 ug/L** in **July**.

The historical data show that the **2007** mean epilimnetic phosphorus concentration is ***slightly less than*** the state median and is ***slightly greater than*** the similar lake median. Refer to Appendix F for more information about the similar lake median.

The current year NLA data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration was **21 ug/L** in **July**.

The historical data show that the **2007** mean hypolimnetic phosphorus concentration is ***much greater than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

Please keep in mind that these trends are based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

As discussed previously, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean phosphorus concentration since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

- **Cyanobacteria**

A **moderate amount** of the cyanobacteria ***Anabaena and Oscillatoria*** were observed in the lake in **August**. ***These cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding cyanobacteria.

Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

The presence of cyanobacteria serves as a reminder of the lake's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the lake by eliminating fertilizer use on lawns, keeping the lake shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads. Other sources may be detected by taking water samples from inlets that feed into the lake.

In addition, residents should also observe the lake in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into scums that accumulate in one section of the lake. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

- **Table 4 and Figure 4: pH**

Table 4 in Appendix B and Figure 4 in Appendix A presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is 6.6, which indicates that the surface waters in the state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH along the tributary system into Mirror Lake this year ranged from **5.66** at the **East Inlet** to **6.91** at **Waumbeck Road**, which means that the water ***slightly acidic***.

The pH tends to decrease along the tributary from Abenaki Lagoon to the West and East Inlets. This is likely due to a wetland system located between Waumbeck Rd. and the West and East Inlets. Wetland systems often have tannic, humic and fulvic acids present. Organic acids naturally occur as a result of decomposing organic matter such as leaves. These acids may also cause the water to be tea colored. In New Hampshire the presence of granite bedrock and acid deposition also naturally lowers the pH of freshwaters.

Due to the presence of granite bedrock in the state and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is not much that can be feasibly done to effectively increase lake and tributary pH.

- **Table 5: Acid Neutralizing Capacity**
  Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the lake has been monitored through VLAP.

  Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

  The mean acid neutralizing capacity (ANC) at the deep spot of Mirror Lake was **8.4 mg/L**, which is greater than the state median. In addition, this indicates that the lake is ***moderately vulnerable*** to acidic inputs.

- **Table 6 and Figure 5: Conductivity**
  Table 6 and in Appendix B and Figure 5 in Appendix A presents the current and historical tributary and in-lake conductivity data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **38.4 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The epilimnetic conductivity at the deep spot this year was **63.10 uMhos/cm**, which is greater than the state median.

The mean tributary conductivity ranged from **271 uMhos/cm** at **Abenaki Lagoon** to **179 uMhos/cm** at **East Inlet**. The conductivity generally decreased from Abenaki Lagoon to the East and West Inlets. Also, the conductivity ***decreased*** from **September** to **November** at each station; however levels remained above 100 uMhos/cm.

Typically, conductivity values exceeding **100 uMhos/cm** generally indicate pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff which contains road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct stream surveys and rain event sampling along the tributaries with elevated conductivity so that we can determine potential sources to the lake. The Wolfeboro Wastewater Treatment Facility has been determined to potentially impact this tributary system (DES Administrative Order No. WD 05-014). The current tributary system water analysis data will help to clarify this issue so that corrective measures may be taken.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2002/documents/Appndxd_monitoring.pdf, or contact the VLAP Coordinator.

We also recommend that your monitoring group conduct a shoreline conductivity survey of the lake and the tributaries with elevated conductivity to help identify the sources of conductivity.

To learn how to conduct a shoreline or tributary conductivity survey, please refer to the 2004 special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2004/documents/Appendix_D.pdf or contact the VLAP Coordinator.

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the lake. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

A limited amount of chloride sampling was conducted during 2007. Please refer to the discussion of Table 13 for more information.

Therefore, we recommend that the epilimnion (upper layer) be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the elevated in-lake conductivity.

Please note that there will be an additional cost for each of the chloride samples and that these samples must be analyzed at the DES laboratory in Concord. In addition, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 7a and Table 7b: Total Kjeldahl Nitrogen and Nitrite+Nitrate Nitrogen**
  Table 7a in Appendix B presents the current year and historical Total Kjeldahl Nitrogen and Table 7b presents the current year and historical nitrite and nitrate nitrogen. Nitrogen is typically the limiting nutrient in estuaries and coastal ecosystems.

  The Mirror Lake deep spot sample collected by the NLA program measured a summer epilimnetic total nitrogen value of **0.32 mg/L**, below the state median nitrogen value of **0.35 mg/L**.

  Nitrogen is an essential nutrient for plant and algal growth. However, in freshwater systems, nitrogen is not typically the limiting nutrient. Therefore, nitrogen is not typically sampled through VLAP. However, if phosphorus concentrations in freshwater are elevated, then nitrogen loading may stimulate additional plant and algal growth. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  Nitrogen- Phosphorus Ratio
  During the most recent NLA survey, which was conducted during Summer 2007, the ratio of the total nitrogen concentration to total phosphorus (TN:TP) concentration in the epilimnion sample was 45**,** which is ***greater than*** 15, indicating that the lake is **phosphorus-limited**. This means that any additional phosphorus loading to the pond will stimulate additional plant and algal growth. Therefore, it is not critical to conduct nitrogen sampling.

- **Table 8 and Figure 6: Total Phosphorus**
  Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Figure 6 in

Appendix A represents the current year total phosphorus data for the tributary system. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The mean total phosphorus concentration ranged from **49 ug/L** at the **West Inlet A** station to **18 ug/L** at the **Waumbeck Rd.** station. The total phosphorus concentration was ***variable*** along the tributary, but generally decreased from **September** to **November**.

Specifically, the total phosphorus concentration was ***elevated*** **(39 and 29 ug/L)** at **Abenaki Lagoon** on the **September** and **October** sampling events. The turbidity was also ***slightly elevated*** **(2.64 and 2.37 NTUs)** during these sampling events.

The total phosphorus concentration was ***elevated*** **(92 and 33 ug/L)** at **West Inlet A** on the **September and October** sampling events and corresponds to a ***slightly elevated*** turbidity **(2.47 and 3.33 NTUs)**.

The total phosphorus concentration was ***elevated*** **(33 ug/L)** at **West Inlet B** on the **September** sampling event, and the turbidity was also ***slightly elevated*** **(2.56 NTUs)**.

The tributary turbidity levels may be a natural background level; however additional sampling is necessary to determine background levels. The turbidity may also have been a result of disturbing the stream bottom while sampling or watershed erosion. When the stream bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting tributary samples, please be sure to sample where the tributary is flowing and where the stream is deep enough to collect a "clean" sample free from organic debris and sediment.

Also, the total phosphorus concentration at the **East Inlet, West Inlet A** and **West Inlet B** sample stations may be affected by the large wetland system upstream of the stations. Wetland systems naturally filter and settle out nutrients from the system; however decomposing organic matter may contribute to phosphorus concentrations, especially after storm events.

We recommend that your monitoring group continue monthly sampling and conduct rain event sampling along this tributary so that we can determine potential sources of elevated phosphorus and turbidity levels. It would also be beneficial for your group to monitor this system bi-weekly or weekly during the months of April, May, and June to assess the affects of spring snow-melt and rainfall, and the commencement of the spray-field irrigation for the wastewater treatment facility.

Due to the unusual circumstances regarding the Wolfeboro Wastewater Treatment Facility impacts upon this tributary system, it would also be beneficial for your group to walk the length of tributary to identify other potential phosphorus sources. Learning the layout of the land may also help us to figure out sources for the variation in phosphorus levels along the length of the brook.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2002/documents/Appndxd_monitoring.pdf, or contact the VLAP Coordinator.

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected by the NLA during **2007**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The dissolved oxygen concentration was greater than **100 percent** saturation between **0.1** and **2.0** meters at the deep spot on the **July** NLA sampling event. Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also increase the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth to which sunlight could penetrate into the water column was approximately **5.75** meters on this sampling event, as shown by the Secchi disk transparency depth, and that the epilimnion, the layer of warmer water temperatures and increased sunlight where algae typically congregate, was located between approximately **0.1** and **4.0** meters, we suspect that an abundance of algae, most likely cyanobacteria, in the epilimnion caused the oxygen super-saturation.

  The dissolved oxygen concentration was ***much lower in the hypolimnion (lower layer) than in the epilimnion (upper layer)*** at the deep spot on the **July** NLA sampling event. As stratified lakes age, and as the summer progresses, oxygen typically becomes ***depleted*** in the hypolimnion by the process of decomposition. Specifically, the reduction of hypolimnetic oxygen is primarily a result of biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the lake where the water meets the sediment. When hypolimnetic oxygen concentration is depleted to less than 1 mg/L, **as it was on the NLA sampling event,** the phosphorus that is normally bound up in the sediment may be re-released into the water column, a process referred to as ***internal phosphorus loading***. ***Low*** hypolimnetic oxygen levels are a sign of the lake's ***aging*** health.

- **Table 11and Figure 7: Turbidity**

  Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Figure 7 in Appendix A depicts the current tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

  The deep spot turbidity, measured by the NLA, was ***relatively low*** this year, which is good news.

  Generally, the tributary turbidity was ***slightly elevated*** at each station this year, which may be a natural occurrence. However, this also suggests that the stream bottom may have been disturbed while sampling or that erosion is occurring in this area of the watershed. When the stream bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting samples in the tributaries, please be sure to sample where the stream is flowing and where the stream is deep enough to collect a "clean" sample free from debris and sediment.

  If you suspect that erosion is occurring in this area of the watershed, we recommend that your monitoring group conduct a stream survey and rain event sampling along this tributary. This additional sampling may allow us to determine what is causing the ***elevated*** levels of turbidity.

  For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2002/documents/Appndxd_monitoring.pdf, or contact the VLAP Coordinator.

- **Table 12: Bacteria (*E.coli*)**

  Table 12 in Appendix B lists the current year and historical data for bacteria *(E.coli)* testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that raw sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

Two in-lake locations were sampled for *E.coli* in **July** as part of the National Lake Assessment. The results were **<10 counts per 100 ml** and **<5 counts per 100ml**, which are both ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and 88 counts per 100 mL for surface waters that are designated public beaches.

If residents are concerned about sources of bacteria, such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

- **Table 13: Chloride**

  Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl^-) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The epilimnion was sampled for chloride in **July** as part of the National Lake Assessment. The result was **10 mg/L**, which is much less than the state acute and chronic chloride criteria. However, this concentration is greater than what we would normally expect to measure in undisturbed New Hampshire surface waters. Also, the eplimnetic chloride concentration has increased from **7 mg/L** measured in 1978 by the DES Lake Survey Program.

  We recommend that your monitoring group continue to conduct chloride sampling in the epilimnion at the deep spot, particularly in the spring soon during snow-melt and during rain events during the summer. This will establish a baseline of data that will assist your monitoring group and DES to determine lake quality trends in the future.

Please note that chloride analyses will be run free of charge at the DES Limnology Center beginning in 2008. Please contact the VLAP Coordinator if you are interested in chloride monitoring. In addition, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 14: Current Year Biological and Chemical Raw Data**
  Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year "raw," meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

- **Table 15: Station Table**
  As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake, the biologist trained your group how to collect tributary samples. Your group learned very quickly and did a great job following instructions.

In future years, the biologist will conduct a "Sampling Procedures Assessment Audit" of your monitoring group during the annual visit. Specifically, the biologist will observe the performance of your monitoring group while sampling and will document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors fail to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a ***very good*** job when collecting samples this year! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify a few aspects of sample collection that your group could improve upon, as follows:

- **Tributary sampling:** Please do not sample tributaries that are not flowing. Due to the lack of flushing, stagnant water typically contains ***elevated*** amounts of chemical and biological constituents that will lead to results that are not representative of the quality of water that typically flows into the lake.

- **Tributary sampling:** Please do not sample tributaries that are too shallow to collect a "clean" sample free from sediment and organic debris. You may need to move upstream or downstream to collect a "clean" sample. If the stream is not deep enough and the bottom sediment is disturbed while sampling, the phosphorus concentration in the sample will likely be ***elevated***.

  In addition, please do not sample tributaries if the bottom sediment has been disturbed as this will likely result in ***elevated*** phosphorus and turbidity concentrations which are not representative of the quality of the water that typically flows into the lake. If you disturb the stream bottom while sampling, please rinse out the bottle and move to an upstream location so that you can sample in an undisturbed area.

- **Sample bottle volume:** Please fill each sample bottle up to the neck of the bottle where the bottle curves in. This will ensure that the laboratory staff will have enough sample water to conduct all of the necessary tests.

  Please be careful to not overflow the small brown bottle used for phosphorus sampling or directly dip this bottle into the stream, since this bottle contains acid. If you do accidentally overflow the small brown bottle, please rinse your hands and the outside of the sample bottle and make a note of this on your field sampling sheet. The laboratory staff will put additional acid in the bottle in the laboratory to preserve the sample.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire's Ecosystems, DES fact sheet ARD-32, (603) 271-2975 or www.des.nh.gov/factsheets/ard/ard-32.htm.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, DES Booklet WD-03-42, (603) 271-2975.

Best Management Practices for Well Drilling Operations, DES fact sheet WD-WSEB-21-4, (603) 271-2975 or www.des.nh.gov/factsheets/ws/ws-21-4.htm.

Biodegradable Soaps and Water Quality, DES fact sheet BB-54, (603) 271-2975 or www.des.nh.gov/factsheets/bb/bb-54.htm.

Canada Geese Facts and Management Options, DES fact sheet BB-53, (603) 271-2975 or www.des.nh.gov/factsheets/bb/bb-53.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, DES fact sheet WMB-10, (603) 271-2975 or www.des.nh.gov/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or www.des.nh.gov/factsheets/sp/sp-1.htm.

Freshwater Jellyfish In New Hampshire, DES fact sheet WD-BB-5, (603) 271-2975 or www.des.nh.gov/factsheets/bb/bb-51/htm.

Impacts of Development Upon Stormwater Runoff, DES fact sheet WD-WQE-7, (603) 271-2975 or www.des.nh.gov/factsheets/wqe/wqe-7.htm.

IPM: An Alternative to Pesticides, DES fact sheet WD-SP-3, (603) 271-2975 or www.des.nh.gov/factsheets/sp/sp-3.htm.

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